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March 7, 2017 17-NWP-022

Mr. Ray J. Corey
Assistant Manager of River and Plateau
Richland Operations Office
United States Department of Energy
PO Box 550, MSIN: A5-11
Richland, Washington, 99352

Re: Dangerous Waste Management Unit (DWMU) 277-T Building Closure Plan Comment Disposition, and Performance Standards for Future Solid Waste Operations Complex (SWOC) Closure Plans

References: See page 2

Dear Mr. Corey:

This letter is in response to the United States Department of Energy's (USDOE) letter (Reference 1), which responded to the Department of Ecology's (Ecology) letter (Reference 2). The referenced letters apply specifically to the 277-T Building Closure Plan comments and to closure performance standards (CPS) for SWOC DWMUs.

Ecology acknowledges that USDOE will implement most of the CPS provided in Attachment 2 of Reference 1. We expect USDOE to use these values in SWOC DWMU closure plans with modifications discussed below. We have attached a final table of closure performance standard cleanup levels.

Ecology does not agree with the particulate emission factor (PEF) that USDOE used to calculate soil inhalation cleanup levels (CULs) for nonvolatile contaminants. Washington Administrative Code (WAC) 173-340-740(3)(c)(iv)(B) states, "Soil cleanup levels that are protective of the indoor and ambient air shall be determined on a site-specific basis." The mass loading factor (MLF) is the inverse of the PEF. The MLF value of 1E-4 g/m^3 from Schreckhise et al (1993) is specified in *Hanford Guidance for Radiological Cleanup* (WDOH/320-015) and is Hanford-specific. This value was used in 100 Area Cleanup Verification work (*Remedial Design Report/Remedial Action Work Plan for the 100 Area*: DOE/RL-96-17, Rev. 6, 2009) and is supported by other sources of information, referenced in the Attachment to this letter.

Ecology reviewed the basis for final cleanup goals for Dangerous Waste Regulations closures on the Central Plateau, and concluded that some criteria may not need to be evaluated in every case if they do not represent a viable pathway for contamination. For example, soil sample analysis results would not necessarily be evaluated against the soil protective of groundwater criteria (or other cleanup levels) for every DWMU. USDOE must demonstrate in the Closure Plan whether potential pathway(s) is/are viable based on site-specific conditions consistent with WAC-173-340 requirements, specifically sections -740, -747, and -702(14), (15), and (16).

Ecology has also made the following decisions in regard to SWOC closure plans:

- USDOE may leave asphalt in place at the 277-T Outdoor Storage Area if soil sample analyses from beneath the asphalt and concrete demonstrate dangerous waste constituent concentrations do not exceed the CPS. Ecology accepts USDOE's conclusion that a full records review was performed for this DWMU; and that this review did not identify deficiencies in facility records, or spills of dangerous waste or dangerous waste constituents. Asphalt at other DWMUs will be evaluated on a case-by-case basis.
- Ecology will not include the decision flow diagram currently provided in the SWOC closure plans in the draft permit documents for public review and comment.
- USDOE did not directly respond to Ecology's comment 3a (e-mail Stuart Luttrell to Mostafa Kamal on September 28, 2016) regarding Equation 11 in ECF-HANFORD-11-0033. This equation should not include the PEF term because this calculation is for volatile contaminants. Please address this comment.

If you have any questions, please contact Stuart Luttrell, Waste Management Section Hydrogeologist, at stuart.luttrell@ecy.wa.gov or (509) 372-7883, or Kelly Elsethagen, Waste Management Section Project Manager, at kelly.elsethagen@ecy.wa.gov or (509) 372-7923.

Sincerely,

Suzanne Dahl
Dangerous Waste Permit Manager
Nuclear Waste Program

sl/jvs
Enclosures (2)

Reference 1: Letter 17-AMRP-0016, dated November 14, 2016, "Dangerous Waste Management Unit (DWMU) 277-T Building Closure Plan Comment Disposition, and Performance Standards for Future Solid Waste Operations Complex (SWOC) Closure Plans"

Reference 2: Letter 16-NWP-012, dated February 23, 2016, "Dangerous Waste Management Unit (DWMU) 277-T Building Closure Plan Comment Disposition, and Performance Standards for Future Solid Waste Operations Complex (SWOC) Closure Plans"

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Enclosure 1.

Basis and Soil Cleanup Levels for Nonvolatile Chemicals for the Dust Inhalation Pathway

As used here, the Particulate Emission Factor (PEF) and Mass Loading Factor (MLF) relate to a contaminant cleanup level (CUL) in soil with its CUL in air. The PEF is based on both empirical and theoretical considerations; the MLF derivation is somewhat simpler and based solely on empirical data. PEF and MLF are inversely related, and units for MLF (g soil/m^3 air) are more intuitive than for PEF (m^3 air/kg soil), because MLF units represent soil mass in a volume of air.

The approach employed by Lindberg (2013) to establish soil CULs for a dust inhalation pathway at the Hanford Site incorporates an MLF (described in terms of a PEF) that is inconsistent with Hanford environmental conditions, characterized by areas of bare soils and high winds. Instead, the MLF recommended by Schreckhise et al (1993) is more relevant to the Hanford Site.

In particular, Lindberg (2013) in ECF-HANFORD-11-0033, Rev 1 calculates a PEF (7.3E10 m^3/kg) with an EPA (2002) method using an air dispersion term for Boise, ID and a Hanford-specific average wind speed (Hoitink et al, 2004). EPA (2002) presents several soil screening equations for inhalation of fugitive dust that include a PEF defined by an air dispersion term for fugitive dusts, windspeed, source area size, and vegetative cover. EPA presents a default PEF (1.36E9 m^3/kg) for both industrial (Equation 4-5) and residential (Equation B-8) scenarios.

In contrast, Schreckhise et al (1993) recommend an average MLF (1E-4 g/m^3) for the Hanford Site that is given in WDOH (1997), and also based on the study of Anspaugh et al (1975a). Anspaugh et al (1975b) recommend this MLF partly based on measurements of particulate air concentrations from 30 nonurban locations (NAPCA, 1968), as well as comparisons between measured and predicted air contaminant concentrations. The mean annual measurement of particulate air concentrations from the 30 nonurban locations was 3.8E-5 g/m^3 (NAPCA, 1968). Anspaugh et al (1975b) present measured airborne radionuclide data from four locations (including three USDOE sites) over several years compared with corresponding predicted values, calculated with an MLF of 1E-4 g/m^3. Measured and predicted air values were highly correlated and validate the 1E-4 g/m^3 MLF factor.

Whicker and Rood (2008) note MLF values that range from 4E-5 g/m^3 in rural areas to 1E-2 g/m^3 above bare fields during high winds, as reported by Hinds (1982). These values are close to or exceed the Schreckhise MLF. These conditions are similar to the Hanford Site, which is characterized by areas of sparsely vegetated/bare soils and high winds. This lends independent support to the Schreckhise value.

The equivalent MLF value presented by Lindberg (2013) is approximately 7000 times lower than the MLF recommended by Shreckhise et al (1993) for the Hanford Site. Based on data provided above, the Schreckhise MLF value is more relevant to the Hanford Site than the MLF equivalent value used by Lindberg (2013). Therefore, the Schreckhise MLF should be employed in the calculation of all nonvolatile contaminant CULs for the dust inhalation pathway in the table of closure performance standards (CPS), attached to Reference 1.

ECF-HANFORD-11-0033 (Table 4-1) identifies which contaminants are nonvolatile (by MTCA criteria). Several of these contaminants are in the Solid Waste Operations Complex closure plan CPS table (i.e., arsenic, barium, cadmium, hexavalent chromium, hexachlorobenzene, mercury, pentachlorophenol, polychlorinated biphenyls, selenium, and vanadium). Table A-1 provides the soil inhalation CULs for these nonvolatile contaminants, calculated with the Schreckhise MLF. These Method B soil inhalation CULs should replace corresponding CULs in the CPS table. Although none of these soil inhalation CULs for non-volatiles are "drivers" in the CPS table (i.e., Ecology or USDOE "proposed" soil exposure CULs, as shown in the CPS table), it is important to identify defensible CULs for all soil exposure pathways. All other soil inhalation CULs in the CPS table are acceptable, because these contaminants are either volatile or have no CUL listed in ECF-HANFORD-11-0033 (Table 7-2).

References:

Anspaugh, L.R. et al. 1975a. *Resuspension and redistribution of plutonium in soils*. Health Physics 29: 571-582.

Anspaugh, L.R. et al. 1975b. *Resuspension and redistribution of plutonium in soils*. Lawrence Livermore Lab. Univ. of CA, UCRL-7641.

EPA. 2002. *Supplemental guidance for developing soil screening levels for Superfund Sites*. OSWER 9355.4-24.

Hinds, W.C. 1982. *Aerosol technology: Properties, behavior, and measurement of airborne particles*. John Wiley & Sons, NY.

Hoitink, D.J. et al. 2004. *Hanford Site climatological summary 2004 with historical data*. PNNL-15160.

Lindberg, S.L. 2013. *Calculation of inhalation PRGs using standard Method B air CULs for 100 area and 300 area RI/FS reports*. ECF-HANFORD-11-0033, Rev 1.

NAPCA. 1968. National Pollution Control Administration (NAPCA). USHEW Report APTD 68-9, Arlington, VA.

Schreckhise, R.G. et al. 1993. *Recommended environmental dose calculation methods and Hanford-specific parameters*. PNL-3777, Rev 2.

WDOH. 1997. *Hanford guidance for radiological cleanup*. WDOH/320-015. Washington State Dept. of Health.

Whicker, F.W. and A.S. Rood. 2008. *Terrestrial food chain pathways: Concepts and models*. Pp. 260-339 in: Till, J.E. and H.A. Grogan (eds), Radiological risk assessment and environmental analysis. Oxford Univ. Press.

Table A-1

Soil Inhalation Cleanup Levels (CULs) for Nonvolatile Contaminants Calculated with the Schreckhise Mass Loading Factor

Nonvolatile Constituent (using MTCA CPF or RfD)*	MTCA Method B--Cancer (mg/kg)	MTCA Method B—Non-cancer (mg/kg)
arsenic	5.81E+00	6.86E+01
barium	NV	2.29E+03
cadmium	1.39E+01	4.57E+01
hexachlorobenzene	5.43E+01	NV
hexavalent chromium	2.98E-01	4.57E+02
hexavalent chromium (using IRIS IUR)**	2.10E+00	
mercury	NV	1.37E+03
pentachlorophenol	4.90E+03	NV
polychlorinated biphenyls	4.39E+01	NV
selenium	NV	9.14E+04
vanadium	NV	4.57E+02

NV = no value

* RfD = reference dose; CPF = cancer potency factor

**IUR=inhalation unit risk

Enclosure 2. Soil Cleanup Levels to meet Closure Performance Standards.

		WAC 173-340-740			WAC 173-340-747	WAC 173-340-7493			WAC 173-340-750							
		Human Health - Direct Contact with Soil			Soil Protective of Groundwater	Ecological Indicator Table 749-3			Human Health - Inhalation of Vapors and Dust		Hanford Background	CHPRC Contract	Soil Cleanup Level[g]			
		A	B	C	D	E	F	G	H	I	J	K	L			
Chemical Name	Chemical Abstracts Service (CAS) No.	Method A Table 740-1 mg/kg	Method B Noncancer mg/kg	Method B Cancer mg/kg	Groundwater Protection mg/kg	Plants mg/kg	Biota mg/kg	Wildlife mg/kg	Method B Cancer mg/kg	Method B Noncancer mg/kg	90th Percentile mg/kg	Allowable PQL mg/kg	Soil Cleanup Level mg/kg	Basis for cleanup level	Notes
acetone	67-64-1		7.20E+04		2.89E+01					1.94E+05		2.00E-02	2.89E+01	Groundwater protection	
arsenic, inorganic[a]	7440-38-2	2.00E+01	2.40E+01	6.67E-01	2.92E+00	1.00E+01	6.00E+01	1.32E+02	5.81E+00	6.86E+01	6.47E+00	1.00E+00	2.00E+01	Method A	See footnote a.
barium and compounds	7440-39-3		1.60E+04		1.65E+03	5.00E+02		1.02E+02		2.29E+03	1.32E+02	5.00E+00	1.32E+02	Soil background	Soil background is larger than the ecological indicator (wildlife). Background reference is DOE/RL-92-24, Rev 4.
benzene	71-43-2	3.00E-02	3.20E+02	1.82E+01	2.82E-02				5.71E-01	2.44E+01		5.00E-03	2.82E-02	Groundwater protection	
cadmium[b]	7440-43-9	2.00E+00	8.00E+01		6.90E-01	4.00E+00	2.00E+01	1.40E+01	1.39E+01	4.57E+01	5.63E-01	5.00E-01	6.90E-01	Groundwater protection	
carbon disulfide	75-15-0		8.00E+03		5.65E+00					3.05E+02		5.00E-03	5.65E+00	Groundwater protection	
carbon tetrachloride	56-23-5		3.20E+02	1.43E+01	4.60E+00				6.12E-01	6.72E+01		5.00E-03	4.60E-02	Groundwater protection	
chlorobenzene	108-90-7		1.60E+03		8.74E-01		4.00E+01			7.28E+01		5.00E-03	8.74E-01	Groundwater protection	
chloroform	67-66-3		8.00E+02	3.23E+01	7.50E-02				2.42E-01	9.98E+01		5.00E-03	7.50E-02	Groundwater protection	
chromium(VI)[c]	18540-29-9	1.90E+01	2.40E+02		1.90E-01	4.20E+01	4.20E+01	6.70E+01	2.10E+00	4.57E+02		5.00E-01	5.00E-01	PQL	The PQL is larger than the soil concentration protective of groundwater value.
copper cyanide[d]	544-92-3		4.00E+02		2.84E+02								2.84E+02	Groundwater protection	
cresol;m-	108-39-4		4.00E+03		4.00E+00								4.00E+00	Groundwater protection	
cresol;o-	95-48-7		4.00E+03		2.33E+00					5.20E+04		3.33E-01	2.33E+00	Groundwater protection	
cresol;p-	106-44-5		8.00E+03		8.00E+00					5.59E+04			8.00E+00	Groundwater protection	
cyanides[d]	57-12-5		4.80E+01							1.92E+01		1.00E+00	1.92E+01	Inhalation	Method B noncancer inhalation value.
cyclohexanone	108-94-1		4.00E+05		1.74E+02					1.14E+04		1.00E-01	1.74E+02	Groundwater protection	
1,2-dichlorobenzene	95-50-1		7.20E+03		7.03E+00					5.46E+02		3.33E-01	7.03E+00	Groundwater protection	
1,4-dichlorobenzene	106-46-7		5.60E+03	1.85E+02	1.24E+00		2.00E+01		1.48E+00	2.38E+03		3.33E-01	1.24E+00	Groundwater Protection	
1,2-dichloroethene	107-06-2		4.80E+02	1.10E+01	2.32E-02				3.51E-01	1.20E+01		5.00E-03	2.32E-02	Groundwater Protection	
dichloroethyl ether	111-44-4			9.09E-01	2.20E-04				2.73E-01			3.33E-01	3.33E-01	PQL	The PQL is greater than the soil concentration protective of groundwater.
1,1-dichloroethylene	75-35-4		4.00E+03		5.01E-02					1.02E+02		1.00E-02	5.01E-02	Groundwater Protection	
2,4-dinitrotoluene	121-14-2		1.60E+02	3.23E+00	1.67E-03				2.05E+06			3.33E-01	3.33E-01	PQL	The PQL is greater than the soil concentration protective of groundwater.
1,4-dioxane	123-91-1		2.40E+03	1.00E+01					1.36E+01	5.76E+04		3.33E-01	1.00E+01	Direct contact	Method B cancer direct contact value.
2-ethoxyethanol	110-80-5		7.20E+03		2.89E+00								2.89E+00	Groundwater protection	

Enclosure 2. Soil Cleanup Levels to meet Closure Performance Standards.

		WAC 173-340-740			WAC 173-340-747	WAC 173-340-7493			WAC 173-340-750							
		Human Health - Direct Contact with Soil			Soil Protective of Groundwater	Ecological Indicator Table 749-3			Human Health - Inhalation of Vapors and Dust		Hanford Background	CHPRC Contract	Soil Cleanup Level[a]			
		A	B	C	D	E	F	G	H	I	J	K	L			
Chemical Name	Chemical Abstracts Service (CAS) No.	Method A Table 740-1 mg/kg	Method B Noncancer mg/kg	Method B Cancer mg/kg	Groundwater Protection mg/kg	Plants mg/kg	Biota mg/kg	Wildlife mg/kg	Method B Cancer mg/kg	Method B Noncancer mg/kg	90th Percentile mg/kg	Allowable PQL mg/kg	Soil Cleanup Level mg/kg	Basis for cleanup level	Notes
ethyl acetate	141-78-6		7.20E+04		2.97E+01							5.00E+00	2.97E+01	Groundwater protection	
ethyl ether	60-29-7		1.60E+04		6.85E+00							1.00E-02	6.85E+00	Groundwater protection	
ethylbenzene	100-41-4	6.00E+00	8.00E+03		6.05E+00				2.28E+00	1.04E+03		5.00E-03	2.28E+00	Inhalation	Method B cancer inhalation value.
formic acid	64-18-6		7.20E+04										7.20E+04	Direct contact	Method B noncancer direct contact.
hexachlorobenzene	118-74-1		6.40E+01	6.25E-01	8.80E-01			1.70E+01	5.43E+01			3.33E-01	6.25E-01	Direct contact	Method B cancer direct contact value.
hexachlorobutadiene	87-68-3		8.00E+01	1.28E+01	6.05E-01				4.96E+00			3.33E-01	6.05E-01	Groundwater Protection	
hexachloroethane	67-72-1		5.60E+01	2.50E+01	4.36E-02				2.47E+00	1.49E+02		3.33E-01	3.33E-01	PQL	The PQL is greater than the soil concentration protective of groundwater.
hydrazine[e]	302-01-2			3.33E-01	6.25E-05				3.72E+04	1.00E+06			6.25E-05	Groundwater protection	
isobutanol (isobutyl alcohol)	78-83-1		2.40E+04		9.70E+00							5.00E-01	9.70E+00	Groundwater protection	Updated based on RAIS-ORNL values: Henry's 4.0E-04 (unitless); Koc 2.92 L/kg; Kd 2.92E-03 L/kg
lead	7439-92-1	2.50E+02			3.00E+03	5.00E+01	5.00E+02	1.18E+02			1.02E+01	5.00E+00	5.00E+01	Ecological plants	
mercury	7439-97-6	2.00E+00		2.40E+01	2.09E+00	3.00E-01	1.00E-01	5.50E+00		1.37E+03	1.31E-02	2.00E-01	2.00E-01	PQL	The PQL is greater than the soil concentration protective of biota.
methanol	67-56-1		1.60E+05		6.43E+01					5.83E+04		5.00E+01	6.43E+01	Groundwater protection	
methyl ethyl ketone	78-93-3		4.80E+04		1.96E+01					2.84E+04		2.00E-02	1.96E+01	Groundwater protection	RAIS-ORNL values: Henry's of 2.33E-03; Koc 4.51 L/kg; Kd 4.51E-03 L/kg
methyl isobutyl ketone	108-10-1		6.40E+03		2.73E+00					1.31E+04		2.00E-02	2.73E+00	Groundwater protection	
methylene chloride	75-09-2	2.00E-02	4.80E+02	5.00E+02	2.18E-02				5.28E+02	5.80E+02		5.00E-03	2.18E-02	Groundwater protection	
methyl methacrylate	80-62-6		1.12E+05		4.73E+01					1.92E+03		3.33E-01	4.73E+01	Groundwater protection	
n-butyl alcohol (1-butanol)	71-36-3		8.00E+03		3.31E+00							2.50E-01	3.31E+00	Groundwater protection	
nitrobenzene	98-95-3		1.60E+02		1.02E-01				1.99E+00	1.31E+02		3.33E-01	3.33E-01	PQL	The PQL is greater than the soil concentration protective of groundwater.
pentachlorophenol	87-86-5		4.00E+02	2.50E+00	1.58E-02	3.00E+00	6.00E+00	4.50E+00	4.90E+03			6.60E-01	6.60E-01	PQL	The PQL is greater than the soil concentration protective of groundwater.
polychlorinated biphenyls (PCBs)	1336-36-3	1.00E+00		5.00E-01	0.115[f]	4.00E+01		6.50E-01	4.39E+01			2.00E-05	1.15E-01	Groundwater protection	
potassium cyanide[d]	151-50-8		1.60E+02										1.60E+02	Direct contact	Method B cancer direct contact value.
pyridine	110-86-1		8.00E+01		4.35E-02							6.60E-01	6.60E-01	PQL	PQL is greater than soil concentration protective of groundwater.
selenium and compounds	7782-49-2		4.00E+02		5.20E+00	1.00E+00	7.00E+01	3.00E-01		9.14E+04	7.80E-01	1.00E+01	1.00E+01	PQL	PQL is greater than soil CUL
silver	7440-22-4		4.00E+02		1.36E+01	2.00E+00					1.67E-01	1.00E+00	2.00E+00	Ecological plants	

Enclosure 2. Soil Cleanup Levels to meet Closure Performance Standards.

		WAC 173-340-740			WAC 173-340-747	WAC 173-340-7493			WAC 173-340-750							
		Human Health - Direct Contact with Soil			Soil Protective of Groundwater	Ecological Indicator Table 749-3			Human Health - Inhalation of Vapors and Dust		Hanford Background	CHPRC Contract	Soil Cleanup Level[g]			
		A	B	C	D	E	F	G	H	I	J	K	L			
Chemical Name	Chemical Abstracts Service (CAS) No.	Method A Table 740-1 mg/kg	Method B Noncancer mg/kg	Method B Cancer mg/kg	Groundwater Protection mg/kg	Plants mg/kg	Biota mg/kg	Wildlife mg/kg	Method B Cancer mg/kg	Method B Noncancer mg/kg	90th Percentile mg/kg	Allowable PQL mg/kg	Soil Cleanup Level mg/kg	Basis for cleanup level	Notes
sodium cyanide[d]	143-33-9		8.00E+01										8.00E+01	Direct contact	Direct contact noncancer.
tetrachloroethylene (PCE)	127-18-4	5.00E-02	4.80E+02	4.76E+02	5.30E-02				1.97E+01	3.75E+01		5.00E-03	5.30E-02	Groundwater protection	
toluene	108-88-3	7.00E+00	6.40E+03		4.65E+00	2.00E+02				4.77E+03		5.00E-03	4.65E+00	Groundwater protection	
1,1,2-trichloro-1,2,2-trifluoroethane	76-13-1		2.40E+06		1.11E+04					1.75E+04		1.00E-02	1.11E+04	Groundwater protection	
1,1,1-trichloroethane	71-55-6	2.00E+00	1.60E+05		1.58E+00					3.65E+03		5.00E-03	1.58E+00	Groundwater protection	
1,1,2-trichloroethane	79-00-5		3.20E+02	1.75E+01	2.78E-02				7.49E-01	4.38E-01		5.00E-03	2.78E-02	Groundwater protection	
trichloroethylene (TCE)	79-01-6	3.00E-02	4.00E+01	1.20E+01	2.64E-02				1.05E+00	1.58E+00		5.00E-03	2.64E-02	Groundwater protection	
vanadium	7440-62-2		4.00E+02		1.60E+03	2.00E+00				4.57E+02	8.51E+01	5.00E+00	8.51E+01	Background	Background and PQL are greater than clean up level for plants. Background reference is DOE/RL-92-24, Rev 4.
vinyl chloride	75-01-4		2.40E+02	6.70E-01	1.83E-03				5.31E-01	4.27E+01		1.00E-02	1.00E-02	PQL	PQL is greater than soil concentration protective of groundwater.
xylene;m-	108-38-3		1.60E+04		1.35E+00					1.04E+02			1.35E+01	Groundwater protection	
xylene;o-	95-47-6		1.60E+04		1.47E+00					1.04E+02		5.00E-03	1.47E+01	Groundwater protection	
xylene;p-	106-42-3		1.60E+04		1.72E+00					1.04E+02			1.72E+01	Groundwater protection	
xylenes	1330-20-7	9.00E+00	1.60E+04		1.46E+01					1.04E+02		1.00E-02	1.46E+01	Groundwater protection	

Notes:

Unless otherwise noted, human health values are from MTCA (WAC 173-340) Cleanup Levels and Risk Calculations (CLARC) database (https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx) or calculated using methods provided in WAC 173-340.

For human health risk assessment, cleanup levels for individual hazardous substances established under Method B shall be adjusted downward to take into account exposure to multiple hazardous substances. This adjustment needs to be made if, without this adjustment, the hazard index would exceed one or the total excess cancer risk would exceed one in one hundred thousand (WAC 173-340-708(5)(a)).

Footnotes

a. Arsenic - The Hanford Site closure performance standard is 20 mg/kg based on a memo, Dave Bradley to Jane Hedges, "Issues associated with establishing soil cleanup levels for arsenic," dated 6/11/2013.

b. Cadmium - Soil cleanup level (CUL) = (Method B Air CUL)/(MLF) = (1.39E-3 ug/m3)/(1E-4 g/m3) = 13.9 mg/kg; where CUL = cleanup level and MLF = mass loading factor (from WDOH/320-015).

c. Chromium(VI) - Soil CUL = (Air CUL)/(MLF) = (2.1E-4 ug/m3)/(1E-4 g/m3) = 2.1 mg/kg; where CUL = cleanup level and MLF = mass loading factor (from WDOH/320-015). Air CUL based on IRIS inhalation unit risk (0.012 [ug/m3]-1) and MTCA Equation 750-2.

d. Copper, potassium and sodium cyanide are analyzed as total cyanide.

e. Hydrazine is volatile and reactive and quantitation is difficult. Its presence in soils is highly unlikely so samples will not be analyzed for hydrazine.

f. PCBs - based on Aroclor-1254.

g. Soil cleanup level and Basis - This is the value if all pathways are considered; a different value and basis might be used if one or more pathways are not considered.

References:

DOE/RL-92-24, Rev 4: Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes, January 2001.

ECF-HANFORD-11-0038, Rev 0: Soil Background for Interim Use at the Hanford Site, CH2MHill Plateau Remediation Company, February 2012.

WDOH. 1997. Hanford guidance for radiological cleanup. WDOH/320-015. Washington State Dept. of Health.

RAIS database: Risk Assessment Information Systems database, Oak Ridge National Laboratory, February 2016.